

Experimental Study on Strength Characteristics of Concrete with Alccofine and Iron Waste as Additives

KIRAN SAGAR T R¹ AND PAVAN P S²

¹PG Scholar, Department of Civil Engineering, FET, JAIN (Deemed-to-be University), Bengaluru-562112, Karnataka, India

²Assistant Professor, Department of Civil Engineering, FET, JAIN (Deemed-to-be University), Bengaluru-562112, Karnataka, India

*Corresponding author: jupg24mtech24474@jainuniversity.ac.in

Abstract

Concrete is one of the most widely used construction materials due to its strength and durability; however, cement production contributes significantly to environmental pollution and high energy consumption. To address these concerns, this study investigates the use of Alccofine-1203 and iron waste as sustainable alternatives in concrete. Alccofine, an ultra-fine slag-based material, acts as a supplementary cementitious material, while iron waste is used as a partial replacement for fine aggregate.

The research focuses on evaluating the mechanical and durability properties of M30 grade concrete with varying replacement levels of 0%, 5%, 10%, and 15%. Standard tests, including slump, compressive strength, and split tensile strength, were conducted at 7 and 28 days. The results indicate that Alccofine improves workability due to its fine particle size and filler effect, while also enhancing strength through the formation of additional calcium silicate hydrate (C-S-H) gel. Iron waste contributes to improved density and interlocking within the concrete matrix.

The optimum performance was observed at 10% replacement, achieving a compressive strength of approximately 33.5 MPa at 28 days, which is higher than conventional concrete. Beyond this level, a slight reduction in strength was noted due to excessive replacement of cement. Overall, the combined use of Alccofine and iron waste enhances strength, durability and sustainability. This approach promotes efficient waste utilization and reduces the environmental impact of concrete production, making it a viable solution for eco-friendly construction.

Keywords

Alccofine-1203; Iron waste; Sustainable concrete; Supplementary cementitious materials; Micro-filler effect; Alkali-silica reaction

1. Introduction

Concrete is one of the most extensively used construction materials in the world due to its versatility, strength and durability. It plays a vital role in infrastructure development, ranging from residential buildings to large-scale industrial and transportation projects. However, the increasing demand for concrete has raised serious environmental concerns, primarily due to the production of cement, which is its key binding ingredient. Cement manufacturing is an energy-intensive process that involves the calcination of limestone at high temperatures, releasing a significant amount of carbon dioxide into the atmosphere. It is estimated that cement production alone contributes a major share of global greenhouse gas emissions, thereby accelerating climate change and environmental degradation.

In addition to greenhouse gas emissions, cement production also leads to depletion of natural resources, air pollution and high energy consumption. The extraction of raw materials such as limestone and clay results in land degradation and ecological imbalance, while the emission of particulate matter and harmful gases adversely affects air quality and human health. Furthermore, the excessive use of natural sand as fine aggregate in concrete has created issues related to resource scarcity and environmental damage, especially due to uncontrolled river sand mining.

To address these challenges, the construction industry is increasingly focusing on sustainable alternatives that can reduce the environmental footprint of concrete without compromising its performance. One of the most effective approaches is the incorporation of supplementary cementitious materials (SCMs), which are industrial by-products that can partially replace cement. Among these, Alccofine-1203 has emerged as a promising ultra-fine material produced from processed slag. Due to its high fineness and reactivity, Alccofine enhances both fresh and hardened properties of concrete. It improves workability, accelerates early strength development and refines the microstructure by filling voids between

particles. Moreover, it participates in pozzolanic reactions with calcium hydroxide to form additional calcium silicate hydrate (C–S–H) gel, which is responsible for the strength and durability of concrete.

Along with the use of Alccofine, the incorporation of iron waste as a partial replacement for fine aggregate offers another sustainable solution. Iron waste, generated as an industrial by-product, can improve the density and mechanical interlocking of concrete when used in appropriate proportions. Its utilization not only enhances the mechanical performance of concrete but also helps in effective waste management and reduces the dependence on natural sand resources.

The combined use of Alccofine and iron waste represents a dual approach to sustainability by improving concrete performance while minimizing environmental impact. By partially replacing conventional materials with these alternatives, it is possible to produce high-strength, durable and eco-friendly concrete. Therefore, this study focuses on evaluating the strength characteristics of concrete incorporating Alccofine and iron waste at different replacement levels. The investigation aims to determine the optimum proportion that provides the best balance between workability, strength and durability, thereby contributing to the development of sustainable construction practices.

2. Literature Review

Mohammed Qureshi et al. (2014) investigated the combined use of fly ash and Alccofine in concrete and observed significant improvement in early-age compressive strength due to the high reactivity of Alccofine. However, the rate of strength gain reduced at later stages, where fly ash contributed to long-term strength through pozzolanic reactions.

Saurav et al. (2014) analyzed compressive strength using different percentages of Alccofine and found that strength increased up to an optimum level of around 10–13%, after which it declined due to reduced cementitious content.

Rajesh et al. (2015) reported that a 10% replacement of cement with Alccofine resulted in maximum strength in high-strength concrete. This improvement was attributed to enhanced particle packing and additional formation of calcium silicate hydrate (C–S–H) gel.

Ghising et al. (2016) concluded that compressive strength increased up to 15% Alccofine replacement, while split tensile strength was optimal at around 10%. They also emphasized the importance of proper curing conditions in achieving improved performance.

Vijaya Sekhar Reddy et al. (2016) studied the combined effect of fly ash and Alccofine and found that the mix achieved higher compressive strength compared to conventional concrete, reaching up to 52 MPa at 28 days due to improved microstructure.

Chakravarthy et al. (2017) observed that compressive strength increased with Alccofine content up to an optimum level of about 16%. Beyond this, strength decreased due to the dilution effect. They also highlighted improvements in durability due to reduced permeability.

Sanjeev Kumar et al. (2019) investigated lightweight concrete using coconut shells and Alccofine. The study revealed that Alccofine effectively compensated for strength loss caused by lightweight aggregates, achieving optimal performance at around 8% replacement.

Balamuralikrishna et al. (2019) studied the combined use of Alccofine and GGBS and reported that a mix containing 10% Alccofine and 30% GGBS showed superior compressive strength and durability due to improved particle packing and reduced porosity.

Gautham Kishore et al. (2020) demonstrated that Alccofine-based ultra-high-performance concrete exhibited higher compressive, tensile, and flexural strength compared to silica fume-based concrete, making it suitable for advanced structural applications.

Sagar et al. (2021) examined the combined effect of fly ash and Alccofine in high-strength concrete. Their study showed that a mix with 20% fly ash and 10% Alccofine achieved superior compressive strength of about 80 MPa at 28 days, indicating strong synergy between the materials.

3. Materials and Methodology

3.1 Materials

Cement

Portland Pozzolona Cement (PPC) was used as the main binding material in this study. Cement plays a crucial role in providing strength and durability to concrete through the hydration process. It has a specific gravity of about 2.88 and good fineness characteristics. It reacts with water to form calcium silicate hydrate (C–S–H) gel, which is responsible for binding the aggregates together. Basic tests such as specific gravity and consistency were conducted to ensure its quality.

Fine Aggregate

Fine aggregate used in this study is crushed stone sand passing through a 4.75 mm sieve. It has a specific gravity of 2.6 and water absorption of 1.8%. Fine aggregate fills the voids between coarse aggregates and contributes to workability and strength of concrete.



Fig 3.1: Fine aggregate

Coarse Aggregate

Coarse aggregates of size 20 mm (passing) and 4.75 mm (retained) were used. They have a specific gravity of 2.75 and low water absorption of 0.25%. Coarse aggregates provide strength, stiffness, and structural stability to the concrete.



Fig 3.2: Coarse aggregate

Alccofine (1203)

Alccofine-1203 is an ultra-fine supplementary cementitious material obtained from processed slag. It has a very high surface area (around 12,000 cm²/g) and it has a specific gravity of 2.86 and acts both as a micro-filler and a reactive material. It enhances workability, strength, and durability by forming additional C–S–H gel through pozzolanic reaction. In this study, it was used as a partial replacement for cement in varying percentages (0%, 5%, 10%, and 15%).



Fig 3.3: Alccofine-1203

Iron Waste

Iron waste, collected from industrial processes, was used as a partial replacement for fine aggregate. It helps in improving density and mechanical interlocking within the concrete matrix. The use of iron waste not only enhances strength up to an optimum level but also promotes sustainable construction by utilizing industrial by-products.



Fig 3.4: Iron Waste

3.2 Mix Design

Table 3.1: Mix proportion

Cement (kg/m ³)	Fine aggregate (kg/m ³)	Coarse aggregate (kg/m ³)
452	621	1116
1	1.37	2.46

Table 3.2: Details of Mix Proportions of Concrete cube

Nomenclature	Alccofine + iron waste(%)	Alccofine (g)	Cement (g)	Iron waste (g)	Fine aggregate (g)	Coarse aggregate (g)	Water (ml)
M ₀	0+0	0	1530	0	2100	3750	650
M _{AF5+FE5}	5+5	76.5	1454	105	1995	3750	650
M _{AF10+FE10}	10+10	153	1377	210	1890	3750	650
M _{AF15+FE15}	15+15	230	1301	315	1785	3750	650

3.3 Methodology

3.3.1 Specimen Preparation

1. Preparing of mould:

- Clean and prepare the mold Ensure that mold is free from dust, oil and other contaminants. Apply a thin layer of mold release agent to prevent the mortar from sticking to the mold
- Concrete specimens were prepared using cube moulds of 150 × 150 × 150 mm and cylindrical moulds measuring 150 mm in diameter and 300 mm in height for both mix design methods. Moulds (cubes, cylinders) are cleaned and oiled before use.

2. Mixing of the Material's:

Required quantity of materials are taken as per the mix design. Dry materials (Alccofine, cement, iron waste, fine aggregate, coarse aggregate) are first mixed by hand mixing for 2-3 minutes. The water is then added gradually to the dry mix. Mixing continues for about 3-5 minutes until a homogeneous and workable mix is obtained.

3. Pouring the concrete into mould and compacting:

- Concrete is placed in moulds in three layers, each layer compacted using: Tamping rod or Table vibrator.
- Surface is finished smoothly.

3.3.2 Curing the Concrete

- Demould after the initial set, carefully remove the mould from the mortar.
- After casting, the samples were kept in water for curing and their properties were evaluated after 7 and 28 days.



Fig 3.5: Casting and curing of concrete specimens

3.3.3 Test on Fresh Concrete

Table 5.5 shows the test carried out on fresh concrete to measure the workability.

Table 3.3: Test conducted on fresh concrete

Sl. No.	Test	Reference
1	Slump	IS 1199–Part 2 (2018)



Fig 3.6: Slump Test

The slump test is carried out to evaluate the workability and consistency of alccofine concrete. A standard slump cone is placed on a flat, non-absorbent surface and filled with freshly prepared alccofine concrete in three equal layers. Each layer is compacted properly using a tamping rod to remove air voids. After filling, the top surface is levelled and the cone is carefully lifted in a vertical direction. The concrete then subsides and the decrease in height is measured as the slump value. This value indicates how easily the alccofine concrete can be mixed, handled and placed. A higher slump represents better flowability, while a lower slump indicates a stiffer mix.

3.3.4 Tests on Hardened Concrete

After curing, Alccofine concrete specimens are tested to evaluate their mechanical performance and durability characteristics. The hardened properties are mainly assessed through standard tests such as compressive strength and split tensile strength. The compressive strength test is carried out on cube specimens using a compression testing machine to determine the load- bearing capacity of the concrete. Similarly, the split tensile strength test is performed on cylindrical specimens to evaluate the tensile behaviour of the material, which is otherwise weak in tension.

Compressive Strength Test on Cube Specimen:

The compression test on a cube specimen is one of the most fundamental methods used to determine the compressive strength of concrete, which is a key parameter in structural design. In this test, a standard cube specimen (typically 150 mm × 150 mm × 150 mm) is cast, cured (usually for 7, 14, or 28 days) and then placed in a compression testing machine (CTM). The load is applied uniformly and gradually on opposite faces of the cube until failure occurs. During loading, the concrete undergoes elastic deformation initially, followed by cracking and eventual crushing. The maximum load at which the specimen fails is recorded and the compressive strength is calculated as the ratio of failure load to the cross-sectional area. The test helps in assessing the quality, uniformity and load-bearing capacity of concrete. The failure pattern typically shows cracks forming parallel to the direction of loading, indicating crushing failure. This test is simple, reliable and widely adopted in construction quality control.

$$\text{Compressive strength} = \text{load at failure} \div \text{cross sectional area}$$

Split Tensile Test on Cylinder Specimen:

The split tensile test, also known as the Brazilian test, is used to determine the tensile strength of concrete indirectly, since concrete is weak in tension and direct tensile testing is difficult to perform. In this method, a cylindrical specimen

(commonly 150 mm in diameter and 300 mm in height) is placed horizontally between the platens of a compression testing machine. A compressive load is applied along the length of the cylinder through narrow strips, creating a uniform tensile stress perpendicular to the applied load. As the load increases, tensile stresses develop along the vertical diameter, eventually causing the specimen to split into two halves. The maximum load at failure is noted and the split tensile strength is calculated using a standard formula involving the load, diameter and length of the cylinder. The failure is characterized by a clean vertical crack along the diameter, indicating tensile rupture. This test is important for evaluating cracking resistance and durability characteristics of concrete.



Fig 3.7: Compression test on cube specimen



Fig 3.8: Split tensile test on cylinder specimen

4. Results and Discussion

4.1 Test Results of Fresh Concrete

Slump Test Results

Table 4.1: Comparison of slump for different % of alccofine +% iron waste

Sl.No.	Nomenclature	Alccofine and iron waste (%)	Slump Value(mm)
1	M ₀	0+0	75
2	M _{AF5+FE5}	5+5	85
3	M _{AF10+FE10}	10+10	95
4	M _{AF15+FE15}	15+15	80

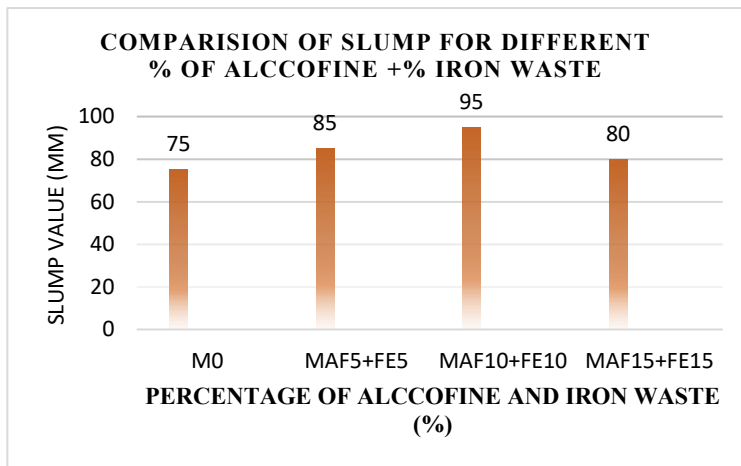


Chart 4.1: Comparison of slump for different % of alccofine + %iron waste

4.2 Test Results of Hardened Concrete

Compression Test Results

Table 4.2: 7 days compressive strength test results

Sl.No.	Nomenclature	Alccofine + iron waste (%)	Load at failure (kN)			Average Load at Failure (kN)	Compressive strength (MPa)
1	M ₀	0+0	392.5	395	397	395	17.5
2	M _{AF5+FE5}	5+5	420	427.5	425	425	19
3	M _{AF10+FE10}	10+10	440	445	442	443	19.55
4	M _{AF15+FE15}	15+15	405	407.5	409	408	18

Table 4.3: 28 days compressive strength test results

Sl.No.	Nomenclature	Alccofine + iron waste (%)	Load at failure (kN)			Average Load at Failure (kN)	Compressive strength (MPa)
1	M ₀	0+0	641	645	648	645	28.6
2	M _{AF5+FE5}	5+5	685	692	695	691	30.5
3	M _{AF10+FE10}	10+10	750	760	757	756	33.5
4	M _{AF15+FE15}	15+15	695	700	692	696	30.8

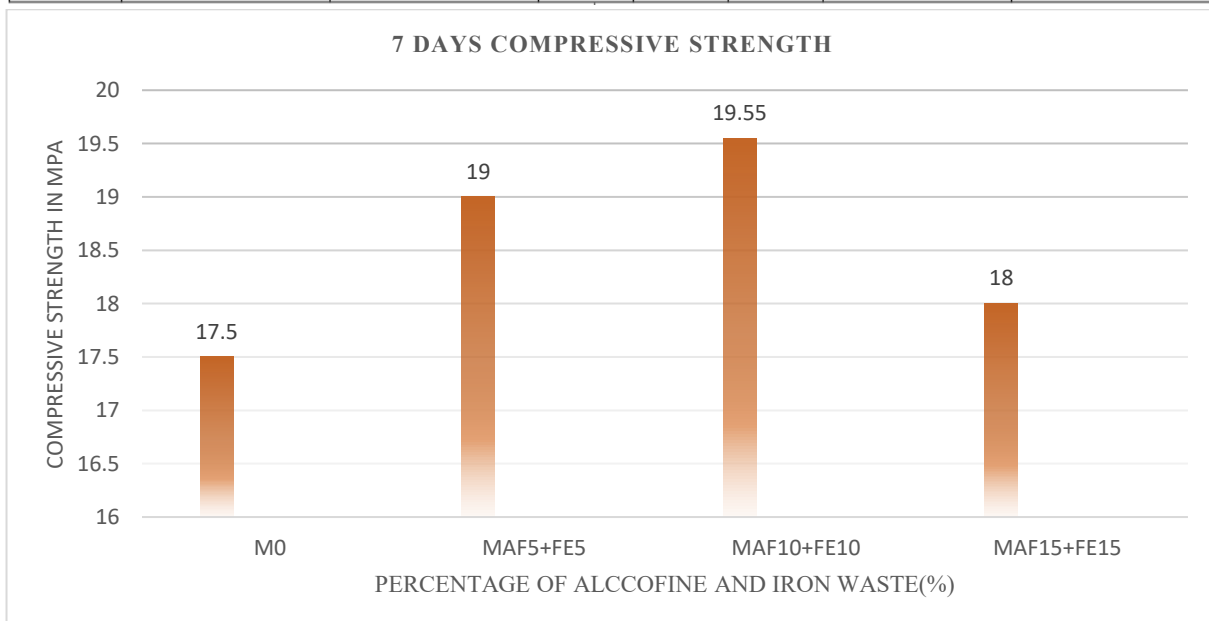


Chart 4.2: Comparison of compression strength for 7 days.

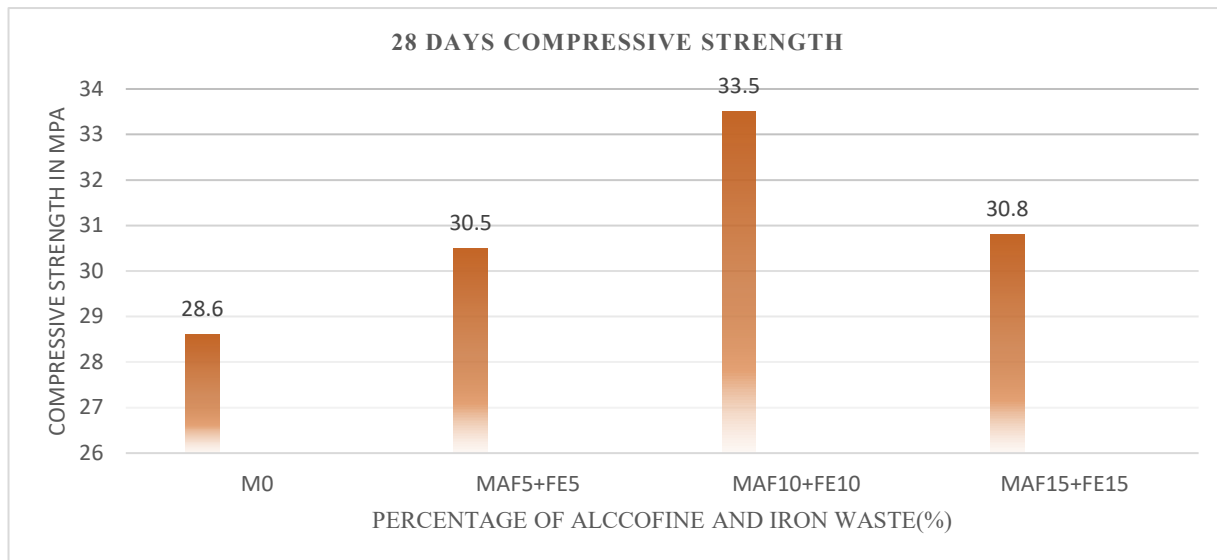


Chart 4.3: Comparison of compressive strength for 28 days.

The 7-day compressive strength of concrete increases with the addition of Alccofine and iron waste up to an optimum level. The strength rises from 17.5 MPa at 0% replacement to a maximum of 19.55 MPa at 10%. Beyond this level, the strength decreases to 18 MPa at 15% replacement. This shows that early strength improvement is effective only up to 10% addition.

The 28-day compressive strength results. The strength increases from 28.6 MPa for the control mix to a peak of 33.5 MPa at 10% replacement. At 15%, the strength drops to 30.8 MPa, indicating reduced performance at higher replacement levels. Overall, both results confirm that the optimum percentage of Alccofine and iron waste is around 10%, beyond which the strength of concrete decreases.



Fig 4.1: Crack pattern observed on cube specimen

Split tensile Strength Test Results

Table 4.4: 7 days split tensile strength test results

Sl.No.	Nomenclature	Alccofine + iron waste (%)	Load at failure (kN)		Average Load at Failure (kN)	Split tensile strength (MPa)
1	M ₀	0+0	260	265	262.5	1.48
2	M _{AF5+FE5}	5+5	275	273	274	1.55
3	M _{AF10+FE10}	10+10	295	303	299	1.68
4	M _{AF15+FE15}	15+15	265	272	268.5	1.50

Table 4.5: 28 days split tensile strength test results

Sl.No.	Nomenclature	Alccofine + iron waste (%)	Load at failure (kN)		Average Load at Failure (kN)	Split tensile strength (MPa)
1	M ₀	0+0	420	427.5	424	2.36
2	M _{AF5+FE5}	5+5	435	442	439	2.47
3	M _{AF10+FE10}	10+10	455	463	459	2.53
4	M _{AF15+FE15}	15+15	440	433	436	2.46

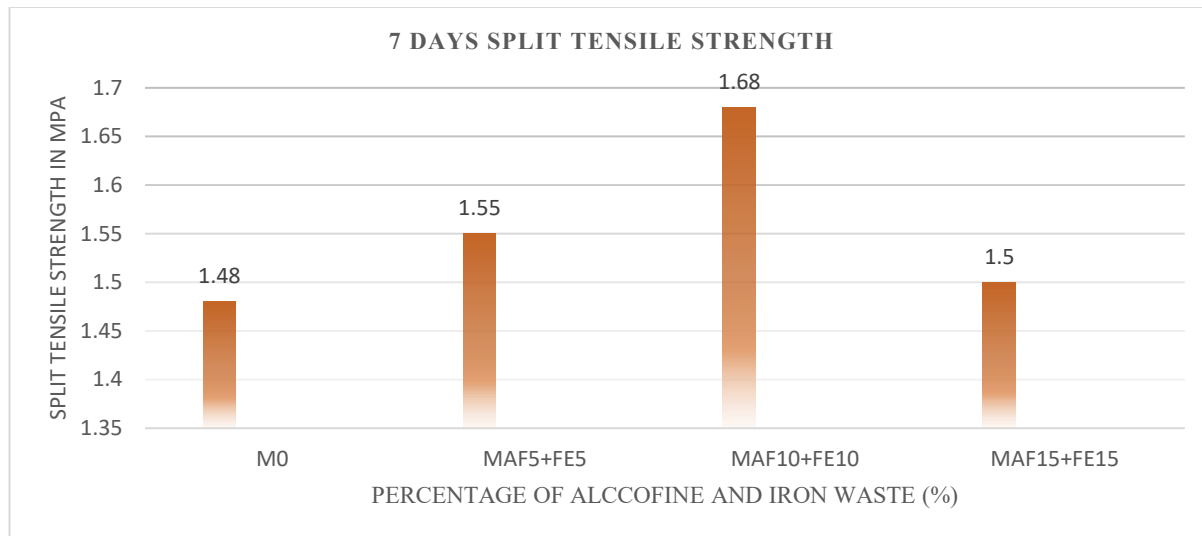


Chart 4.4: Comparison of split tensile strength for 7 days.

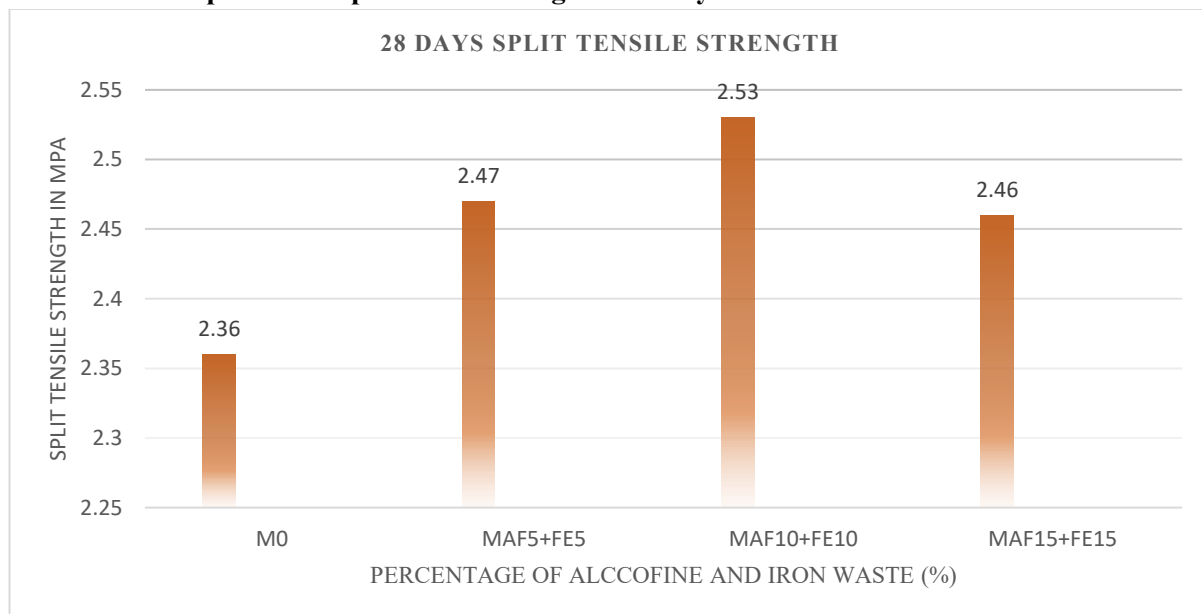


Chart 4.5: Comparison of split tensile strength for 28 days.

At 7 days with different percentages of Alccofine and iron waste. The results indicate a gradual increase in strength from 1.48 MPa for the control mix (0% replacement) to a maximum of 1.68 MPa at 10% replacement. This improvement can be attributed to better particle packing and enhanced bonding within the concrete matrix. However, when the replacement level is increased to 15%, the strength decreases to 1.50 MPa. This reduction suggests that excess Alccofine and iron waste may lead to weaker interfacial bonding and reduced cohesion. Overall, the results show that the optimum replacement level for achieving maximum early tensile strength is around 10%. The graphical representation clearly demonstrates this increasing and then decreasing trend. At 28 days for varying percentages of Alccofine and iron waste. The strength increases from 2.36 MPa at 0% replacement to a peak value of 2.53 MPa at 10% replacement, indicating

improved long-term performance due to better microstructure development. At 15% replacement, the strength slightly decreases to 2.46 MPa, though it remains higher than the control mix. This behavior confirms that moderate inclusion of Alccofine and iron waste enhances tensile strength, but excessive replacement negatively affects performance. Hence, 10% replacement is identified as the optimum level for achieving maximum split tensile strength at 28 days. The bar chart effectively highlights this trend.



Fig 4.2: Crack pattern observed on cylinder specimen

5. Conclusion and Scope for Future Work

5.1 Conclusion

1. Optimal Percentage of Sand Replacement with Iron Waste

The experimental results indicate that replacing fine aggregate with iron waste improves both compressive and split tensile strength up to an optimum level. The best performance was observed at 10% iron waste replacement, where split tensile strength reached 2.53 MPa at 28 days, compared to 2.36 MPa for conventional concrete. Beyond this level, strength reduced, indicating that excessive replacement negatively affects performance.

2. Impact of Alccofine on Compressive Strength

The study clearly shows that the incorporation of Alccofine significantly improves the compressive strength of concrete up to an optimum level. From the experimental results, compressive strength increased from 28.6 MPa (0%) to 33.5 MPa (10%) at 28 days, indicating a substantial enhancement. However, beyond 10% replacement, strength decreased, confirming that 10% Alccofine is the optimum content for achieving maximum strength.

3. Recommendations for Sustainable Concrete Manufacturing

Based on the findings of this study, the following recommendations are proposed:

- Use Alccofine as a partial cement replacement in the range of 8–12% for general structural applications to achieve a balance between strength, durability, and sustainability.
- Replace fine aggregate with iron waste up to 15–20% to enhance strength while maintaining workability and avoiding segregation issues.

5.2 Future Scope

1. Environmental Impact and Sustainability: Alccofine-1203 is considered an environmentally friendly material because it helps reduce carbon dioxide emissions compared to traditional cement. Using it in concrete can lower the overall environmental impact of construction activities.

2. Use of Alternative Waste Materials: There is good potential to combine Alccofine with other industrial waste materials. In this study, iron filings were used instead of natural sand and which helps reduce the overuse of river sand and promotes better waste utilization.

3. Improved Workability: Due to its extremely fine particle size (around 4–6 microns), Alccofine fills the tiny voids in concrete. This improves the flow and ease of handling without causing issues like segregation or bleeding, making it suitable for heavily reinforced structures.

4. Support for Sustainable Development: With the rapid growth in population and construction needs, using such materials provides a practical solution. It helps meet construction demands while also promoting environmentally responsible and sustainable development.

Acknowledgement

The authors express their sincere gratitude to the management of JAIN (Deemed-to-be University) for providing the necessary infrastructure and academic environment to successfully carry out this research work. The continuous support and encouragement extended by the institution played a vital role in the completion of this study. The authors would like to convey their deep appreciation to the Department of Civil Engineering for granting access to laboratory facilities and resources required for experimental investigations. The technical assistance provided by the laboratory staff during material testing and specimen preparation is also gratefully acknowledged. Special thanks are extended to the project guide for their valuable suggestions, constructive feedback, and consistent guidance throughout the research process. Their expertise and insights significantly contributed to improving the quality and outcome of this work.

Reference

- [1] M. Vijaya Sekhar Reddy, K. Ashalatha and K. Surendra Studies on Eco-Friendly Concrete by Partial Replacement of Cement with Alccofine and Fine Fly Ash vol. 11, NO. 5, 2016
- [2] Ansari U.S., Chaudhri I.M., Ghuge N.P., Phatangre R.R High- Performance Concrete with Partial Replacement of Cement by ALCCOFINE & Fly Ash Vol. 5, No.2,2015
- [3] Mohammed Qureshi, Yogendra Tandel, Bhavin Patel Experimental Study on High Strength Concrete using Fly Ash and Alccofine Vol. 2, (4),2014
- [4] Bhanavath Sagar and M V N Sivakumar (2021) "Use of Alccofine-1203 in Concrete: Review on Mechanical and Durability Properties"
- [5] B Sagar and M V N Sivakumar (2020) "An Experimental and Analytical Study on Alccofine Based High Strength Concrete"
- [6] IS 10262 (2009): Guidelines for concrete mix design proportioning.
- [7] IS 456(2000) : Plain and Reinforced Concrete.
- [8] IS 9103(1999) : Specification for Concrete Admixture.
- [9] IS 383 (1970):Specification for Coarse and Fine Aggregates From Natural Sources for Concrete.
- [10] S.Tiwari and P. Gangwar, "Evaluate the effect of acid attack on rubberised concrete using crumb tyre rubber and replacement of cement by alccofine," Materials Today Proceedings, vol. 47, pp. 3778-3782, Jan. 2021, doi: 10.1016/j.matpr.2021.03.006
- [11] B. Harish, N. R. Dakshinamurthy, M. Sridhar and K. J. Rao, "A study on mechanical properties of high strength concrete with alccofine as partial replacement of cement," Materials Today Proceedings, vol. 52, pp. 1201-1210, Dec. 2021, doi: 10.1016/j.matpr.2021.11.037
- [12] G. T. Kumaar, S. Gunasekar and N. Ramesh, "Impact of Alccofine on the strength and durability properties of concrete," Materials Today Proceedings, Nov. 2023, doi: 10.1016/j.matpr.2023.11.036
- [13] B.L.N. Sai Srinath, Chandan Kumar Patnaikuni, K.V.G.D. Balaji, B. Santhosh Kumar and M. Manjunatha, "A prospective review of alccofine as supplementary cementitious material," Materials Today Proceedings, 2021, doi: 10.1016/j.matpr.2021.03.719.
- [14] 10.1016/j.matpr.2021.03.719.
- [15] Dr. R. Manju, V. S. S. Ganapathy, S. Indira and P. Sony, "Experimental investigation on concrete using animal bones as a partial replacement of coarse aggregate in addition of alccofine as an admixture," Materials Today Proceedings, Aug.2023, doi: 10.1016/j.matpr.2023.07.369
- [16] Praveen Nayak S, H. S. Raghunandan V.Kadaba, "Hardened Properties of Concretes made with Micro Silica and Alccofine- A Performance Optimization based Comparative Study, International Journal of Engineering Research and Development e-ISSN: 2278-067X, p-ISSN: 2278- 800X, www.ijerd.com Volume 10, Issue 8 (August 2014), PP.01-09
- [17] Parvathy Karthika, A, Lakshmi Priya, N, Abinayaa A, Rajesh kumar K (2018), Experimental Study on Strength and Durability of High Strength Concrete using Fly Ash & Alccofine", International Journal of Science Technology and Engineering, 4(8), 68-69.
- [18] Saurabh Gupta, Sanjay Sharma, Devinder Sharma (2015) "A Review on Alccofine: A supplementary cementitious material" International Journal of Modern Trends in Engineering and Research, 2(8), 114-118
- [19] Yatin H Patel, P.J.Patel, Prof. Jignesh M Patel, Dr. H.S. Patel, Study On Durability Of High Performance Concrete With Alccofine And Fly Ash, "International Journal of Advanced Engineering Research and Studies.

On Effect Of High Performance Concrete With Alccofine And Waste Glass Powder, "International Journal for Scientific Research & Development.

[20] Bletty Baby, Jerry Anto, "Study of Properties of SelfResearch And Technology (IJERT), Vol. 2 Issue 9, pp. 3074-3076, 2013.Compacting Concrete with Micro Steel Fibers and Alccofine", International Research Journal of Advanced Engineering and Science, Volume 2, Issue 2, pp. 83-87, 2017

[21] Devinder Sharma, Saurabh Gupta, Ashish Kapoor, Anu Sharma "A Review on Alccofine- A New generation Micro Fine Concrete Material for High Strength Concrete" National Conference on Sustainable Infrastructure Development, pp. 68-75, Feb. 2016"Alccofine" By Counto Micro fine Products Pvt. Ltd. (A joint venture with ambuja cement ltd andalcon developers)

IS Standards Codes

- [1] IS: 4031-1988-Methods of physical test for hydraulic cement (First Revision)" Bureau of Indian standards.
- [2] IS 10262:2019 is "Concrete Mix Proportioning — Guidelines (Second Revision)
- [3] IS 7320:1974 – Slump test
- [4] IS 516 (Part 1/Sec 1):2021 – Compressive strength
- [5] IS 5816:1999 – Split tensile strength